Levels of analysis in knee surgery

Meijer, O.G.; van den Dikkenberg, N.

published in
Knee Surgery, Sports Traumatology, Arthroscopy
2003

DOI (link to publisher)
10.1007/s00167-002-0325-8

document version
Publisher's PDF, also known as Version of record

Knee Surg Sports Traumatol Arthrosc
(2003) 11 : 53–54

LETTER TO THE EDITOR

DOI 10.1007/s00167-002-0325-8

Levels of analysis in knee surgery

Onno G. Meijer
Nicolette van den Dikkenberg

Published online: 18 December 2002

O. G. Meijer (✉) · N. van den Dikkenberg
Faculty of Human Movement Sciences,
Vrije Universiteit,
Van der Boechorststraat 9,
1081 BT Amsterdam, The Netherlands
Tel.: +31-20-4448590,
Fax: +31-20-4448529,
e-mail: o_g_meijer@fbw.vu.nl

Dear Editor:

As corresponding and first authors of the article on objective measurement of functional abilities in knee patients [5], we thank Ejnar Eriksson [1] for his editorial reaction. We agree with many points, but contrary to Eriksson's implicit suggestion, we do not think that the DynaPort KneeTest is a competitor to kinematic analysis in the gait laboratory since the KneeTest aims at another level of analysis.

In our contribution we distinguished three levels of analysis: joints, muscles, ligaments, etc., including the kinematics of the prosthesis; patients' actual functional abilities; and patients' self-reports. These are different levels of organization, where higher levels can retain their order notwithstanding changes at the lower levels [2] (whereas close to a transition small changes at the lower level can have major consequences for the higher one). Thus patients with different limb and trunk kinematics may have the same functional abilities simply because persons can perform the same function with different movements.

Not surprisingly, patients' self-reports were found to have low correlations with actual functional abilities [4, 6], in the order of 0.4, implying not more than 16% common variance. Functional abilities are different from patients' self-reports; therefore it is wisdom to measure both.

Similarly, functional abilities have no 1:1 relationships with underlying kinematics. Comparing "the effect of different prostheses on gait" [1], one needs to distinguish gait as a functional ability from gait as a collection of detailed kinematic/kinetic events. The construction of prostheses may have matured so much that no major differences are to be expected at the level of function, at least not in the first years after surgery. Indeed, such differences were not reported in research with the DynaPort KneeTest (René Verdonk, Gait Analysis Symposium, ESSKA Conference, Rome, 2002). We agree with Dr. Eriksson that differences between prostheses reveal themselves optimally at the level of kinematics/kinetics, as measured by full-blown gait analysis. Such gait analysis and the DynaPort KneeTest aim at different levels, and we see them as complementing each other.

In its attempt to derive function from kinematic data, the DynaPort KneeTest appears to be ambiguous with respect to levels. Does it indeed measure function rather than kinematics? It collapses a variety of tasks, derives numerous movement parameters from each, and gives a score of 0 if a particular function cannot be performed. From all measured "basic parameters" (tasks×movement parameters) those were picked that significantly discriminated between patients and

healthy controls. Most parameters were unstable in a test-retest study, but collectively they were not, and as a whole they improved when the patient improved. We take this as compelling evidence that the overall scores of the DynaPort KneeTest are a valid indicator of functional abilities (not just of gait).

Who would need objective assessment of functional abilities? Anyone who is interested in the level of function when performing intervention studies or fundamental analyses of prerequisites for function, when deciding whether to perform knee arthroplasty or in aftercare. After knee arthroplasty a majority of patients have trouble with at least some daily activities [3]. Researchers should do their utmost to make information about function available to professionals involved. Such information can now be obtained inexpensively (buying the necessary equipment is always much cheaper than setting-up a gait laboratory), and efficiently (the DynaPort KneeTest takes about 30 min to administer and analyze). We expect that objective evaluation of functional abilities will prove itself indispensable for daily practice as well as research.

Acknowledgements We thank Claudine Lamoth, Hans van den Berg, Rienk van der Slikke, Jaap van Dieën, Rob van Lummel, René Verdonk, and Erik Witvrouw for their constructive comments on an earlier version of this letter.

References

1. Eriksson E (2002) Gait analysis. Knee Surg Sports Traumatol Arthrosc 10:203
2. Haken H (2000) Information and self-organization: a macroscopic approach to complex systems, 2nd edn. Springer, Berlin Heidelberg New York
3. Hawker G, Wright J, Coyte P, Paul J, Dittus R, Croxford R, Katz B, Bombardier C, Heck D, Freund D (1998) Health-related quality of life after knee replacement. J Bone Joint Surg Am 80:163–173
4. Terwee CB, Van der Slikke RMA, Benink RJ, Meijers WGH, Schillemans PF, Meijer OG, Van den Dikkenberg N, Van Lummel RC (2002). Performance-based methods or self-report questionnaires to asses functional outcome of total knee replacement? A comparison of the newly developed DynaPort knee test with the Knee Society Score, WOMAC, and the SF-36. J Arthroplasty (in press)
5. Van den Dikkenberg N, Meijer OG, Van der Slikke RMA, Van Lummel RC, Van Dieën JH, Pijls B, Benink RJ, Wuisman PIJM (2002) Measuring functional abilities of patients with knee problems: rationale and construction of the DynaPort knee test. Knee Surg Sports Traumatol Arthrosc 10:204–212
6. Witvrouw E, Victor J, Bellemans J, Rock B, Van Lummel R, Van der Slikke R, Verdonk R (2002) A correlation study of objective functionality and WOMAC in total knee arthroplasty. Knee Surg Sports Traumatol Arthrosc 10:347–351